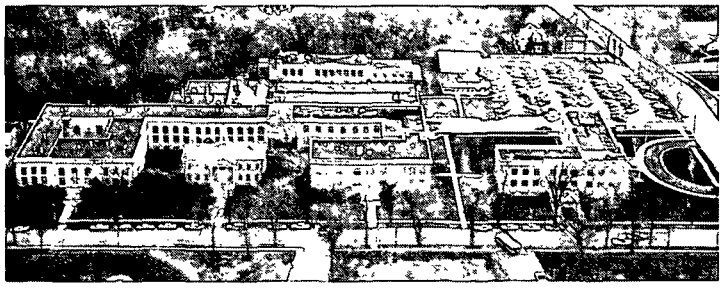

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OXYGEN BLEACHING'S PACE QUICKENS
A SUMMARY OF THE 1987 INTERNATIONAL OXYGEN DELIGNIFICATION CONFERENCE

T. J. McDONOUGH

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Oxygen Bleaching's Pace Quickens

A Summary of the 1987 International Oxygen Delignification Conference, San Diego, June 7-12, 1987

T. J. McDonough

This paper was prepared at TAPPI's request and will appear in the August Issue of Tappi Journal, minus the Appendix which is included in this Technical Paper Series

Oxygen bleaching's pace quickens

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Like the missionaries that preceded them centuries earlier, the oxygen bleachers came to San Diego bearing good news: there are promising alternatives to using large amounts of chlorine in the bleach plant, and their attractiveness is growing. The occasion, of course, was the first-ever International Oxygen Delignification Conference, June 7-12, sponsored by TAPPI. It attracted 276 delegates from 18 countries on four continents, fully justifying both its existence and the "international" designation.

Oxygen bleaching, first introduced to the industry in 1970, has been slow to be adopted outside Sweden, where it was embraced early and where it continues to undergo active development. In North America, widespread use of secondary effluent treatment reduced the need for its pollution abatement features and made it difficult to justify the high capital costs associated with bleaching at high consistency. But now, the advent of fluidizing, medium-consistency mixers, continuing concern for the environment, the changing face of environmental regulations, and new economic realities are all combining to accelerate commercialization in North America, Japan and elsewhere.

Each of these factors, and some additional ones, were amply illustrated and explored at the San Diego conference. Program Chairman Earl Malcolm and Conference Chairman Rudra Singh guided the construction of an excellent program that comprised 35 preprinted scientific and technical papers and a total of 45 presentations.

In one of these, Ingemar Croon keynoted the meeting with his prognostications of the "high tech mill." It will use a pulping process of the modified kraft type, or one based on liquors containing sulfite and anthraquinone, but not organic solvents. Oxygen will be used extensively, partly because of its improved cost position relative to chlorine and chlorine dioxide, which are more energy-intensive, and partly because of tighter environmental restrictions. Chlorine usage will be reduced to very low levels, necessitating on-site generation of caustic by a modification of the recovery cycle. The wood will be "activated" before pulping and the resulting pulp, after pretreatment with nitrogen oxides, will be bleached in a sequence such as (EO)(CD)(EO)DD.

Does oxygen make cents?

The stage thus set, the conference began in earnest with a review of the status of oxygen bleaching technology by Larry Tench, who included a comprehensive list of installations worldwide, with startup date, bleach sequence and other useful information about each one. Shortly thereafter, the passion with which the chlorinophobes practice their art came to the fore. The trigger was a presentation by Raimo Malinen of Jaako Poyry, who dared state that oxygen delignification does not make economic sense, and that there are better ways to achieve reductions of BOD and COD (although he conceded that it is one of the better approaches to dealing with TOCl, color and toxicity problems). He was immediately set upon by numerous staunch defenders of the technology, among them Kristina Idner of AF-IPK, who later in the week gave a presentation that embodied her own view of oxygen's chances. She arrived at more favorable estimates of capital requirements and operating savings, concluding that oxygen projects can be economically justified.

The swing to medium consistency

The main purpose of Idner's presentation was to compare the newer medium consistency (MC) technology with the well-established high consistency (HC) approach. The principal factors to be considered are capital cost, selectivity, chemical consumption and degree of delignification attainable. In her view, all but chemical consumption favor the MC alternative. Norm Liebergott, in reviewing Paprican research on process variable effects, was not in full agreement; his data showed no discernible selectivity advantage of lowering consistency from 25 to 7%. Malinen downplayed the capital cost advantage, but pointed out that the MC system is simpler and easier to install in existing mills, is less sensitive to the degree of preoxygen washing and benefits from competition among a greater number of suppliers. Tench observed that, among existing commercial installations, the HC systems are achieving greater degrees of delignification and cited this as an advantage.

Whatever the results of the generalized calculations, the observable fact is that the MC versions have achieved dominance. This becomes apparent from consulting Tench's list and counting installations for the period 1985-89. The score: MC 18, HC 1.

The TOCl question

With MC and PRENOX as possible exceptions, the acronym heard most often during the week was TOCl. It played a prominent part in Croon's vision of the future, and was seen by Malinen as a major reason for considering oxygen. When it came Rolf Brannland's turn to present, the audience's entire attention was focused on it.

Short for total organically bound chlorine, it is a method developed at STFI (the Swedish Forest Products Research Laboratory) for characterizing bleaching effluents. Although intended as a research tool, it was adopted as a control parameter in a number of decisions by the Swedish environmental authorities. Furthermore, and with debatable justification, it has been used as the basis for stringent regulations governing the quality of effluents discharged by five Swedish mills. Outside Sweden, these developments have been viewed with a mixture of skepticism and apprehension. Within the country, they have occasioned much research aimed at finding feasible ways of achieving the very low levels demanded (1.5 kg/t vs. the 9 kg/t generated in a conventional chlorine-based sequence).

Brannland's talk surveyed some alternatives: modified cooking, oxygen bleaching, pretreatments to allow extended oxygen bleaching, chlorine dioxide substitution, membrane filtration, and combinations of these strategies. An economic comparison is not yet possible because several of the methods are still in the developmental stage. It seems likely, however, that compliance will carry with it a substantial cost.

Extending the limits

TOCl is but one of a list of effluent parameters that are favorably impacted by oxygen predelignification and recycling of the effluent to the kraft recovery system. In general, the more extensive the delignification, the greater the effect. The challenge, of course, is to extend delignification without allowing carbohydrate degradation to affect pulp quality.

One approach is to modify the kraft cook to improve its selectivity and give an improved starting point for the oxygen stage. Krister Sjoblom presented the results of an STFI study which concluded that the best way to do this is to cook

to kappa 28 in a modified (controlled liquor concentration profiles) cook, delignify with oxygen to kappa 12, and then bleach in a three stage sequence. This minimizes cost while reducing TOCl and other effluent parameters to very low levels. In the ensuing discussion, it was pointed out that using only three stages after oxygen can make it difficult to maintain constant product quality and can lead to brightness stability problems.

Another way to skin the same cat is to adopt Olof Samuelson's nitrogen dioxide pretreatment [the PRENOX ® Process]. In his account of the status of this technology, Professor Samuelson speculated, on the basis of laboratory studies, that it will be possible to reduce the kappa number of a kraft pulp to the extremely low level of 3.5 in an oxygen stage, without affecting pulp quality. In his view, this will be accomplished by what he refers to as the S3 process: pretreating with NO_2 in the absence of oxygen, then "ripening" in acid sodium nitrate solution before oxygen delignification.

Nitrogen dioxide is not alone in its ability to facilitate a subsequent oxygen delignification stage. Nick Soteland presented the results of a laboratory investigation of the use of chlorine for the same purpose. Very low post-oxygen kappa numbers are accessible, at the cost of having to dispose of the pretreatment effluent and tolerating some chlorine compounds in the oxygen stage effluent. Dominique Lachenal, who had earlier investigated chlorine pretreatments, reported data from a study of a related process, the OxO sequence, in which x represents treatment with a small amount of Cl_2, ClO_2, or NO_2. Lachenal would recycle only the effluent from the first O-stage and discharge the rest, but so little Cl_2 is needed that the OcODED sequence would produce only 1 kg TOCl per tonne of pulp. No strength loss is envisioned, but yield may be 1% lower than in a conventional sequence. Yet another pretreatment, acidic

hydrogen peroxide, was described by Hans Suss. It accelerates lignin removal in the oxygen stage, but is limited to a 5 to 10% increase in total delignification.

Getting some help from peroxide

Hydrogen peroxide holds promise for intensifying and complementing the effect of oxygen in other ways, too. In the longer term, if an appropriate catalyst can be found, it may even serve as an economical replacement for oxygen as a delignifying agent. Walter Peter's presentation showed that, at least for now, it is more economical to use mixtures of oxygen and peroxide. The Lenzing mill in Austria pioneered the use of pure hydrogen peroxide to replace chlorine in the bleaching of sulfite dissolving pulp. Peter's paper described the implementation of a subsequent partial replacement of peroxide by oxygen. The mixture is more effective than either component. Tom McDonough's presentation showed that delignification with hydrogen peroxide can be made very selective by adding a small amount of manganese ion. Manganese was also shown to accelerate both delignification and peroxide decomposition. The two go hand in hand, as anticipated from earlier model compound studies.

Blair Althouse described various ways of using hydrogen peroxide and oxygen to reduce the amount of hypochlorite used in chemical pulp bleaching. Numerous examples were given, including direct substitution of peroxide for hypochlorite and putting oxygen (and perhaps also peroxide) in the extraction stage to eliminate a subsequent hypo stage.

Let's make our own oxygen

In some localities it is economically advantageous to manufacture low purity oxygen on site rather than buy pure liquid oxygen. The obvious question is,

Will the application tolerate the impurity? Barbara Van Lierop provided a partial answer in the form of laboratory results on the effect of oxygen purity on oxygen delignification and oxygen extraction. In the latter case, the surprising answer was that there is very little effect of reducing the oxygen concentration (in nitrogen) from 100 to 21%! Before buying an air compressor to replace the oxygen supply for your EO stage, however, consider the effect of all that inert gas on the operation of your mixer and extraction washer.

The effect in a predelignification stage was somewhat greater, but not intolerable, as shown in a presentation by H. Iwase of Jujo Paper Co., whose Kushiro mill has been using low purity oxygen in a high consistency oxygen stage since 1976. It is manufactured on site in a pressure swing adsorption plant. The consumption of oxygen is only slightly higher than when pure oxygen is used.

The growing store of experience

Several accounts of startup and operating experience with medium consistency oxygen systems gave the impression that producers are becoming increasingly comfortable with the new technology. Steve Enz led off with a description of the system at Consolidated Papers in Wisconsin Rapids, started up less than a year ago. This hardwood system has met its major objective - a production increase of 100 t/day. Another recently commissioned U.S. installation was described in a panel presentation by Dennis Didier of Champion's Pensacola mill. It features parallel hardwood and softwood lines, achieving brightnesses of 88 and 87, respectively, in the O(CD)(EO)D sequence. No serious problems have been encountered.

On the same panel was Peder Kleppe, who described the current state of the continuously evolving pioneer installation at Moss, Norway. Kappa 60

polysulfide-anthraquinone pulp is pretreated with SO_2 (!), passes through an MC tramp metal separator, an in-line refiner, an MC mixer and an oxygen stage that reduces the kappa number by more than 50%. Future plans call for an increase in the unbleached kappa number to 100, MC screening and blowline oxygen delignification.

Atmospheric oxygen predelignification was also much in evidence at the conference, both in laboratory and mill presentations. One of the latter was made by Kari Kovasin, whose paper described the hydrostatic system at Rauma and the pressurized system at the Niigata mill of Hokuetsu Paper.

Mill experience with oxygen-enriched extraction stages was related by several authors, among them Haruhiko Kawabata who had the unique opportunity of comparing four mill EO systems that differed in mixing power, residence time, inlet pulp conditions and oxygen dosage. Among his conclusions was the finding that a system with direct injection of oxygen into a tower equipped with a slowly rotating arm mixer was as effective as one in which the oxygen was dispersed in a fluidizing mixer. John Cirucci reached a similar conclusion when he compared direct injection to high shear mixing in a mill equipped with identical parallel lines.

Pushing back the frontiers

The variety of information presented at the meeting cannot be effectively summarized in a short report. Fundamental studies of the reactions of hydroxyl radicals with lignin, presented by Kenji Tatsumi, furnished information that transcends the boundaries between oxygen, ozone and peroxide bleaching processes. A comprehensive review of the production, detection and reactions of active oxygen-containing species by Ajit Singh will provide grist for the oxygen

bleaching researcher's mill. Norm Thompson's portrayal of the havoc wreaked upon pulp fibers by superoxide underlines the importance of achieving a better understanding of the principles governing the selectivity of oxygen bleaching. Sten Ljunggren's studies of the reactions of lignin model compounds contributes to this understanding and Jeff Hsieh's work on oxygen bleaching kinetics quantitatively describes the process.

Other papers described oxygen bleaching reactor design, additional mill operations, a process for enhancing the efficiency of the extraction stage by preventing lignin recondensation, ozone generation and bleaching, systems for on-site manufacture of oxygen, further information on the effects and mechanism of nitrogen dioxide pretreatments, oxygen as a pretreatment to improve digestibility in enzymatic saccharification, and oxygen pulping of rice straw.

The complete collection is available, in the form of a 252-page preprint book, from TAPPI. I recommend it as the most up-to-date snapshot of the technology currently available.

APPENDIX

ABSTRACTS OF PRESENTATIONS MADE AT THE 1987 INTERNATIONAL OXYGEN DELIGNIFICATION CONFERENCE

An abbreviated abstract of each of the presentations, including the panel presentations, can be found on the following pages. The first line of each entry consists of an arbitrarily assigned abstract number (for indexing purposes) and a second identifier, which is the number assigned to the paper in the original conference program. Its first two digits are the session number, and the second two give the order of presentation within the session. The round-tables on Monday, Tuesday, and Thursday were not numbered in the program; they have been assigned numbers of 11, 12, and 13, respectively.

The abstracts are extremely brief capsule summaries, usually shorter than, and often different from the abstracts written by the authors of the papers. An attempt has also been made to include a very short synopsis of the discussion that followed each paper.

These abstracts were prepared by the author of this report to allow early communication of the conference proceedings to the IPC membership. They should not be confused with abstracts of the same papers that will appear in the Abstract Bulletin of The Institute of Paper Chemistry in the near future. The latter conform to different standards and will be more complete.

The current collection is preceded by a one-page index, based on a few selected keywords. These were chosen to reflect the major topics covered by the presentations. Each entry consists of an abstract's index number followed by its program number.

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TOCL

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02401
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02401 0101
CROON, I.

KEYNOTE ADDRESS, 1987 OXYGEN DELIGNIFICATION CONFERENCE, SAN DIEGO
T. MCDONOUGH'S NOTES ON THE CONF., P. 1
AFTER BRIEFLY OUTLINING THE HISTORY OF THE DEVELOPMENT OF OXYGEN BLEACHING, CROON PROGNOSTICATED ABOUT PULPING AND BLEACHING. ALKALINE SULFITE-AQ AND SULFIDE-SULFITE-AQ PULPING WILL BE COMMERCIAL IN NEAR FUTURE, SOLVENT PULPING NOT BEFORE 2000. KRAFT WILL REMAIN DOMINANT BUT BLEACHING WILL CHANGE, E.G MOD KRAFT, PRENOX, OXYGEN, SHORT SEQ (EO)(CD)(ED)D. NEXT GEN: WOOD ACTIVN, VERY LOW CL2 USE TO ALLOW CLOSURE, ON SITE NAOH, CACO3, SO2, ETC., LARGER FASTER PMS, NEW PRODUCTS.

02402
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02402 0201
TENCH, L., AND HARPER, S.

OXYGEN BLEACHING PRACTICES AND BENEFITS - AN OVERVIEW
PROC. 1987 INT. OXYGEN DELIGN. CONF., P.1
A LIST OF WORLDWIDE OXYGEN DELIGNIFICATION INSTALLATIONS AND A SUMMARY OF THE EXPERIENCE GAINED TO DATE ARE PRESENTED. ACTIVITY IN JAPAN HAS RECENTLY BEEN AT A HIGH LEVEL. INSTALLATIONS THERE CAN BE JUSTIFIED ON CHEMICAL COST ALONE. PULP QUALITY, ENV. BENEFITS, RECOVERY, ENERGY, HIGH VS. MED. CONSY., WASHING AND SCREENING ARE DISCUSSED. DISCN: ACKNOWLEDGED SWING TO MC BUT SAID HC WOULD LIVE ON DUE TO GREATER POSSIBLE EXTENT OF DELIGN; KLEPPE DISAGREED.

02403
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02403 0202
ENZ, S.M., AND EMMERLING, F.A.

N. AMERICA'S FIRST FULLY INTEG MED. CONSY. OXYGEN DELIGN. STAGE
PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 13
THE TITLE STAGE WENT ON STREAM IN SEPTEMBER 1986 AT CONSOLIDATED PAPERS, WISC. RAPIDS. AN AVERAGE KAPPA NO. REDN. OF 43% ALLOWED A HARDWOOD PULP PRODN. INCREASE OF 100 T/D, MAINTAINING AN AVERAGE FINAL BRIGHTNESS OF 90.5 TAPPI WITH MINIMAL REVERSION. IT HAS ALSO ALLOWED A REDN. OF PEROXIDE ADDN. TO HD STORAGE AND REDUCED CHEM CONSUMPN. IN THE (CD)(ED)D SEQUENCE. DISCN.: NO MG USED, MC OVER HC FOR SPACE, CO IN BLOW TANK, NO SHIVE PROBS, HIGH PRODN. RATE WITHOUT O-STAGE GAVE LOW BRT POOR CNTRL

02404
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02404 0203
ARHIPPAINEN, B., AND MALINEN, R.
COST COMPETITIVENESS OF OXYGEN BLEACHING
PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 23.
A STUDY BY THE FIRM JAAKO POYRY SHOWED THAT MED. CONSY. OXYGEN BLEACHING IS NOT COST COMPETITIVE. IF THE POST OXYGEN SEQUENCE CAN BE SHORTENED TO 3 OR 4 STAGES IT BECOMES NEARLY COMPETITIVE. IT ALSO DOES IF IT CAN SAVE POLLUTION ABATEMENT COSTS, UNLIKELY FOR BOD, COD BUT POSSIBLY FOR TOCL, COLOR, TOXICITY. DISCN.: MUCH SKEPTICISM, ESPECIALLY ON CHEM. COST SAVINGS AND CAPITAL COST ASSNS. USED; QUALITY AND EXPLOSIONS NOT PROBS., MUST CONSIDER PMKG PT OF VIEW, FLEX'Y, TOCL

02405
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02405 0301
TOSAKA, K., AND HAYASHI, J.

ALKALI-OXYGEN PULPING OF RICE STRAW
PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 29
RICE STRAW WAS PULPED IN TWO STAGES, THE SECOND BEING OXYGEN AT 1-5 KG/CM2 AT 80-120 DEG. C FOR 60 MIN. THREE TYPES OF FIRST STAGE WERE STUDIED: SOAKING IN 1-3% NAOH SOLN. AT 20-120 DEG. C FOR 10-180 MIN. FLD. BY SQUEEZING, SPRAYING WITH NAOH FLD. BY STANDING AT 20-60 DEG. C, AND BOILING IN H2O FLD. BY SPRAYING. PULP YIELDS WERE 44-50% WITH GOOD STRENGTH AND BRTNS. OF

45-67. DISCN.: RICE STRAW PULPING IS IN ITS INFANCY IN JAPAN THERE BEING 2 SMALL PLANTS, BUT THERE'S MUCH POTENTIAL.

02406

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02406 0302

SHIMIZU, Y., HAYASHI, J., AND TOSAKA, T.

ENZYMATIC SACCHARIFICATION OF GRASSES PRETREATED BY OXYGEN OXIDATION

PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 35.

DIGESTIBILITY OF BAGASSE BY CELLULOLYTIC ENZYMES WAS INCREASED BY OXYGEN DELIGNIFICATION AFTER SOAKING OR SPRAYING WITH NAOH SOLUTION. AN UNPRESSURIZED OXYGEN STAGE WAS EFFECTIVE. THE OXYGEN-ALKALI TREATMENT INCREASED CRYSTALLINITY; DIGESTIBILITY INCREASED WITH INCREASING DELIGNIFICATION, INDICATING THAT CRYSTALLINITY IMPEDES THE ENZYME LESS THAN LIGNIN.

02407

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02407 1101

COLLINS, B.

EQUIPMENT ADVANCES DRIVEN BY PROCESS CHANGES

T. MCDONOUGH'S NOTES ON THE 1987 OXYGEN DELIGN. CONF., P. 11

MOST NEW EQUIPMENT DEVELOPMENTS FOR OXYGEN BLEACH PLANTS ARE IN THE MIXING AND WASHING AREAS. THEY INCLUDE FLUIDIZING MEDIUM CONSISTENCY MIXERS, PRESSURE DIFFUSERS AND WASH PRESSES. DIGESTER MODIFICATIONS FOR EXTENDED COOKING, BLOWLINE MC TRAMP METAL SEPARATORS AND MC SCREENS ARE RELATED DEVELOPMENTS. SVETOGORSK (MC O IN BLOWLINE) AND GRUVON (MOD K + HC O) INSTS. WERE DESCR. DISCN: CARRYOVER TO O2 STAGE PERHAPS NOT AS BAD AS THOUGHT; BLOTANK MAYBE NOT NEEDED AFTER MC O-ST.

02408

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02408 1102

MCBRIDE, T.

THE OPTIKAPPA SENSOR

T. MCDONOUGH'S NOTES ON 1987 INT. OXYGEN DELIGN. CONF., P.

THE STFI-DEVELOPED OPTIKAPPA SENSOR FOR ONLINE KAPPA NUMBER SENSING IS BEING MARKETED IN NORTH AMERICA BY ASEA. THE FIRST INSTALLATION WAS AT MONSTERAS; THERE ARE NOW 12, ALL BUT ONE IN OXYGEN BLEACH PLANTS. IT DEPENDS ON A EURCONTROL DEVICE SAMPLING AT 2-5% CONSY THE SAMPLE IS DILUTED, WASHED AND SENSED. TWO UV DETECTORS, ONE FOR LIGNIN ONE TO CHECK FOR SUFFICIENT FIBER. GOOD OVER KAPPA RANGE 2-105 BUT DATA SHOWN ONLY FOR 2-55. DISCN.: NOT YET USED FOR C OR EO STAGES.

02409

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02409 1103

HALLENBECK, M.

THE HEAT BALANCE AROUND AN OXYGEN BLEACH PLANT WASHING SYSTEM

T. MCDONOUGH'S NOTES ON 1987 INT. OXYGEN DELIGN. CONF., P. 12.

TO PREVENT FLASHING IN FIRST WASHER DROPLEG IT IS NECESSARY EITHER TO COOL THE VAT DILUTION IN A HEAT EXCHANGER OR TO USE PRESSURE WASHER SUCH AS THE COMPACTION BAFFLE FILTER. IN THE FORMER CASE, STEAM CONSUMPTION WILL RISE. A HEAT EXCHGR MAY BE DESIRABLE TO MAINTAIN COLD BLOW EVEN IF PRESSURE WASHERS ARE USED. CB FILTER LOADINGS 3X AS HIGH AS VAC FILTERS; HAVE PRESSURE REPULPER, ALLOWING STEAM ADDN. DISCN.: REACTORS NEED HIGH ASPECT RATIO, NOT IN-TOWER DISTRIBUTOR; TOWERS OVERDESIGNED.

02410

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02410 1104

GREEN, G.

WHITE LIQUOR OXIDATION

T. MCDONOUGH'S NOTES ON 1987 INT. OXYGEN DELIGN. CONF., P. 13.

OXIDIZED WHITE LIQUOR (OWL) IS ABOUT HALF AS COSTLY AS NAOH. OXIDATION CONVERTS SULFIDE TO THIOSULF-ATE AND IS DONE WITH O2 OR AIR AT ABOUT 85 DEG. C. CAPITAL COST OF AIR SYSTEM IS HIGHER BECAUSE OF CATALYST BED, FILTER AND COMPRESSOR; O&M COSTS ALSO HIGH. O2 SYSTEM NEEDS NONE OF THESE AND EXCESS O2

FROM PROCESS CAN BE USED ELSEWHERE. DISCN.: MOST EXISTING SYSTEMS WORK ON AIR BECAUSE OPERATING COSTS ARE LOWER; THIOSULFATE APPARENTLY DOES NOT CAUSE CORROSION IN OWL SYSTEMS.

02411
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02411 1105
KOVASIN, K.

EQUIPMENT FOR MEDIUM CONSISTENCY OXYGEN BLEACHING
T. MCDONOUGH'S NOTES ON 1987 INT. OXYGEN DELIGN. CONF., P. 13.
KEY ITEMS ARE MIXER, REACTOR, WASHERS. BELOIT-RAUMA-REPOLA ROM MIXER PROVIDES RESIDENCE TIME TO GENERATE UNIFORMLY SMALL BUBBLES AND TO SMOOTH FLOW. REACTOR MUST BE DESIGNED TO AVOID CHANNELING AND ALLOW FOR GAS HOLDUP. POST-O2 WASHER NEEDS NORDEN EFFICIENCY OF 3.5-4.5. DISCN.: MUST KEEP VELOCITY HIGH IN REACTOR AND USE DISTRIBUTOR TO AVOID CHANNELLING.

02412
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02412 1106
PANEL MEMBERS (SEE ENTRIES 2407-2411)
ROUNDTABLE ON EQUIPMENT ADVANCES
T. MCDONOUGH'S NOTES ON 1987 INT. OXYGEN DELIGN. CONF., P. 14
DISCUSSION FOLLOWING PRESENTATIONS BY THE PANEL MEMBERS INCLUDED, IN ADDITION TO THAT NOTED ABOVE: BLACK LIQUOR CARRYOVER INTO MC O STAGE MAY HAVE BENEFICIAL EFFECT ON CARBOHYDRATE PROTECTION. ON CHANNELING, KAMYR PREFERS DISTRIBUTOR OVER HIGH ASPECT RATIO TO CONTROL PRESSURE DROP. A. SINGH SUGGESTED CONSIDERING DISSOLUTION OF OXYGEN IN THE FIBERS' LIGNIN COMPONENT. LIMITATION ON RETROFITTING DIGESTERS FOR MODIFIED KRAFT IS BEING ABLE TO MAINTAIN UPFLOW IN COUNTERCURRENT ZONE.

02413
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02413 0401
SAMUELSON, O.

ALTERNATIVE PRETREATMENTS BEFORE OXYGEN BLEACHING
PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 45
NO2 PRETRTMT. OF KRAFT PULP ALLOWED OXYGEN BLEACHING TO KAPPA 3.5 WITHOUT SERIOUS CARBOHYDRATE DEGRDN. THREE METHODS HAVE BEEN IDENTIFIED. S1 PROCESS:O2 ADDED AFTER NO2 TO UTILIZE BYPRODUCT NO; S2 PROC.:LITTLE OR NO O2 ADDED, BUT PRETRTMT CONDITIONS MORE SEVERE AND NO-CONTG. GAS IS RECYCLED; S3 PROC.: AFTER INITIAL NO2 TRTMT. PULP IS "RIPENED" IN ACID NANO3 SOLN SIMULATING RECYCLED FILTRATE. DISCN.: S1 SIMPLEST, S3 MOST EFFECTIVE; CARBOHYDR. PROTECTION MECH. UNKNOWN; EFF. ON RCVRY CYCL UNKN.

02414
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02414 0402
THOMPSON, N.S., AND CORBETT, H.M.
THE EFFECT OF NITROGEN DIOXIDE PRETREATMENTS ON ++ OXYGEN BLEACHED ++
PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 53
PINE KRAFT PULPS WERE REACTED WITH NITROGEN OXIDES AND BLEACHED WITH OXYGEN AT VARIOUS ALKALI ADDITION LEVLS. THE CARBOHYDRATE PROTECTION EFFECT WAS GREATER THAN THE DELIGNIFICATION ACCELERATION EFFECT. THE PRETRTMTS. HAD BENEFICIAL EFFECTS ON THE ZERO-SPAN STRENGTH OF THE OXYGEN BLEACHED PULPS.

02415
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02415 0403
BRANNLAND, R. AND FOSSUM, G.

HOW TO COPE WITH TOCL

PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 57.
DETRIMENTAL EFFECTS OF TOCL ON RECEIVING WATERS THAT PROMPTED SWEDISH AUTHORITIES TO RESTRICT IT ARE REVIEWED. CONTROL METHODS INCLUDE MODIFIED COOKING, OXYGEN DELIGNIFICATION, WITH OR WITHOUT PRETREATMENTS, CLO2 SUBSTN. AND MEMBRANE FILTRATION. ADVANTAGES AND DISADVANTAGES AND TECHNICAL AND ECONOMIC FEASIBILITY OF THESE ARE DISCUSSED. DISCN.: TOCL TOO COMPLEX TO BE SATISFACTORY CONTROL PARAMETER; CLO2 CAN BE USED AS OXYGEN PRETREATMENT UNDER FORCING

CONDNS; SWEDES WON'T STUDY XTRNL TRTMT.

02416

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02416 0404

SOTELAND, N.

PRETREATMENT OF PULPS WITH CHLORINE BEFORE OXYGEN DELIGNIFICATION
PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 63.

PRETREATMENT OF UNBLEACHED PULPS WITH SMALL AMOUNTS OF CHLORINE BEFORE AN OXYGEN STAGE IMPROVES DELIGNIFICATION. CO IS MORE EFFECTIVE THAN OC OR OCE. 2 PRECHLORINATIONS AND 2 OXYGEN STAGES GIVES VERY LOW KAPPA PULPS WITH 2% CL2. IT IS HOPED THAT THE CL IN THE O EFFL'NT IS SMALL ENOUGH TO RECYCL. DISCN.: REEVE CONCERNED ABOUT DISCHGING C EFFLUENT BECAUSE OF CARRYOVER; ANY ACID PRETRTMT REQUIRES HIGH CAPITAL AND CAUSES CA DEPOSITION PROBLEM.

02417

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02417 0405

LACHENAL, D., DECHOUDENS, C., BOURSON, L., AND LACHAPELLE, R.C.

FULL BLEACHING OF CHEMICAL PULP WITH LOW CHARGES OF CHLORINE
PROC. 1987 INT. OXYGEN DELIGN. CONF., P 69

SFTWD KRAFT WAS DELIGNIFIED TO KAPPA 3 BY THE OXO OR OXP PROCESS WHERE X IS CL2, CLO2 OR NO2. TYPICALLY THE X STAGE WAS DONE AT MED CONSY AND 70 DEG. C WITH 1% CHEM. CL2 AND CLO2 WERE MORE EFFICIENT THAN NO2. THE SEQUENCES WERE COMPLETED TO 89 BRTNS WITH DED OR DP PARTIAL SEQUENCES. DISCN.: DRAWBACKS: 1% LOWER YIELD, CAPITAL FOR MC O2. NO SHIVE PROBL. PERFECT WASHING WAS USED. ONLY 1ST O-STAGE EFFL. NEEDS TO BE RECYCLED. SAMUELSON CLAIMS CAN GET SAM RESULTS WITH NO2 PRETRTMT AND SINGLE O-STAGE.

02418

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02418 0501

JAIN, S.K., AND MARU, S.S

A SHORT SEQUENCE ++ FOR DIS-SOLVING PULPS FROM ++ TROPICAL HARDWOODS
PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 75.

COMPARISON OF SEVERAL SEQUENCES SHOWED THAT (EO)C(EO)D WAS BEST FOR COST, QUALITY AND APPLICABILITY COMPARED TO THE PRESENT CEHED SEQUENCE. SEQUENCES WITH BOTH O AND H GAVE POOR VISCOSITY. THE EXPTL PULP WAS HIGH IN ASH AND POOR IN FILTRATION BUT THIS WOULD BE IMPROVED BY MILL ACID WASH. DISCN.: SI COMES IN WITH WOOD. H IS NOT HOT HYPO.

02419

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02419 0502

CIRUCCI, J.F., COSTA, D.S., PITA, P.M.,AND MANZI, D.

DIRECT INJECTION VS. DYNAMIC MIXING: A MILL SCALE COMPARISON ++
PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 81.

THE RIPASA MILL IN BRAZIL HAS TWO IDENTICAL EO STAGES FOLLOWING A COMMON CHLORINATION OF EUCALYPTUS KRAFT. THE DYNAMIC MIXER ON ONE LINE WAS BYPASSED AND OXYGEN AND STEAM WERE INJECTD DIRECTLY DNSTRM OF MC PUMP. THIS REDUCED POWER AND STEAM CONSUMPTION AND MAINTAINED ORIGINAL BRIGHTNESS AND QUALITY LEVELS. DISCN.: ALREADY WIDELY PRACTICED IN SCANDINAVIA. CAUSTIC IN REPULPER. DOESN'T KNOW OF ANY ADV. OF ADDING STEAM AFTER O2. MAY BE GETTING BUBBLE BRKUP BY FLUIDIZATION.

02420

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02420 0503

KAWABATA, H.

COMPARISON OF ++ EO SYSTEMS IN MITSUBISHI PAPER MILLS
PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 87.

MITSUBISHI PAPER MILLS HAS 4 EO SYSTEMS DIFFERING IN MIXING POWER, RESIDENCE TIME, INLET PULP CONDITIONS AND OXYGEN DOSAGE. RESULTS OF MILL OPERATIONS WERE COMPARED AND THE SYSTEMS WERE SIMULATED IN THE LABORATORY. IN PLANT B O2 IS DIRECTLY INJECTED INTO THE TOWER UNDER A SLOW ROTATING ARM MIXER THAT MAKES 1.2 MM LAYERS. THIS WAS AS GOOD AS MC MIXER; MC PUMP + MC MIXER BEST.

02421
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02421 0504
ELTON, E.F.

PEROXIDE REINFORCED ALKALI
EXTRACTION IN CONV ++ AND SLC PROCESSES
PROC. 1987 INT. OXYGEN DELIGN.
CONF., P. 91.
IN THE SLC PROCESS LIGNIN PPTN
DURING EXTRN IS PREVENTED BY WITHDRAWING
BULK OF FILTRATE EARLY, REMOVING LIGNIN
FROM IT AND RECYCLING IT. ADDING H2O2
OR HYPOCHLORITE GIVES FURTHER IMPROVMNT.
H EFFECT IS SIMILAR TO THAT OF P AT LOW
CHARGES. DISCN.: ALTHOUGH H IS MORE COST
EFFECTIVE P IS PREFERRED FOR PULP
VISCOSITY AND CHCL3 ELIMN.

02422
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02422 1201
REEVES, R.

A PARTIALLY SUCCESSFUL EO
INSTALLATION
T. MCDONOUGH'S NOTES ON 1987
INT. OXYGEN DELIGN. CONF., P.27.
BOISE'S WALULA BLEACH PLNT WAS
CEDED, NOW C(EO)(HD)(EP)D. EO: MC PUMP,
2 MICRON DISPERSER, KOMAX STATIC MIXER.
(ST. HELENS DID OK WITH NO EO MIXING)
10 #/T O2 PH 11.1->9.3. D SAVINGS 3# VS
THE EXPECTED 4.5; CEK 4.9->4.2 VS THE
EXPECTED 3.7. INSTALLED BACK P VALVE
WITH NO EFFECT; NO CHANNELLING; WILL TRY
REDUCING C CHGE AND IMPROVING SCRNG; NOW
USING D TO BLCH SHIVES.

02423
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02423 1202
DIDIER, D.R.

CHAMPION PENSACOLA'S OXYGEN
BLEACHING SYSTEM
T. MCDONOUGH'S NOTES ON 1987
INT. OXYGEN DELIGN. CONF., P. 27.
PLANT DESCRN.: PARALLEL LINES
O(CD)(EO)D 800 AND 600 T/D, ONE SW AND
ONE HW, INTERCHANGEABLE; SCREENS->DECKR
->O2 REACTOR->BLOWTANK->2 WASHERS->HD.
TEMP, PRESS, K, VISC: HW-185,60,7.5,27;
SW-195,75,12,19.BRTNS: HW 86-88; SW 85-
87. GOOD STARTUP, NO QUALITY PROBLEMS.
DISCN.: HT EXCHGR TO PREVENT DROPLEG
FLASHING; RADIAL DISTRIBUTOR IN TOWER;
REACTOR DIMENSIONS 13.5'X79' OR X97'; NO
CHANNELING IF CONSY STAYS HIGH ENOUGH;
ALKALI CHARGE MAINTAINED CONSTANT UNLESS
INCOMING K AWAY OFF; CAN GET 89SW, 90HW

02424
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02424 1203
KLEPPE, P.J.

MEDIUM CONSISTENCY OXYGEN
DELIGNIFICATION AT MOSS, NORWAY
T. MCDONOUGH'S NOTES ON 1987
INT. OXYGEN DELIGN. CONF., P. 28.
KAPPA 62 POLYSULFIDE-AQ PULP
IS PRETREATED WITH SO2 THEN MC OXYGEN
DELIGNIFIED TO KAPPA 27. O CONDS: 3.6%
O2, 2.7% NAOH, NO MG, 110-120 DEG. C, 5
ATM. HAVE MC TRAMP SEPARATOR, IN-LINE
REFINER. FUTURE: 100 KAPPA TO 80 WITH O2
IN BLOWLINE, TO 30 IN MC-O2. NOW PUTTING
MC SCREEN IN LINE TO O2 REACTOR. DISCN.:
SO2 PRETRTMT AT PH 7-8 JUST BEFORE IN-
LINE DIFFUSER, WITH 1-1.5% SO2; O2
REACTOR CONTROLLED BY MONITRING DENSITY.
(POLS MILL IS KAPPA 34->17, WITH MG ADD-
ITION, 2 MC MIXERS, 2 P DFUSRS AFTR D.)

02425
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02425 1204
TATSUISHI, H.

MEDIUM CONSISTENCY OXYGEN
DELIGNIFICATION AT HOKEUTSU PAPER MILLS
T. MCDONOUGH'S NOTES ON 1987
INT. OXYGEN DELIGN. CONF., P. 29.
THIS BELOIT RAUMA SYSTEM
CONVERTED A CEHD TO AN OCEHD PLANT AND
WAS JUSTIFIED BY REDUCED BRTNS REVERSION
AND CHEMICAL COST. IT DELIGNIFIES 480 T/
D HW PULP FROM KAPPA 20 TO 10 AT 1000
VISC. O CONDS.: 100 DEG C., 0.4 MPA AT
TOP, 60 MIN., 1.2 % O2, 1.4% NAOH, NO
MG. TOWER IS 3M X 25M. KAPPA IS 16 AFTER
MIXER, 11 AT REACTOR TOP, 10 ON WASHER.

02426
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02426 0601
TATSUMI, K., MURAYAMA, K., AND
TERASHIMA, N.
REACTION OF LIGNIN WITH

HYDROXYL RADICALS
PROC. 1987 INT. OXYGEN DELIGN.
CONF., P. 99.
HYDROXYL RADICALS ARE PRESENT
IN PEROXIDE AND OXYGEN BLEACHING SYSTMS.
THIS MODEL STUDY OF THEIR REACTIONS
SHOWED THAT THE INITIAL STEP IS ADDITION
TO THE RING. THE RESULTING RADICALS
DECAY INTO VARIOUS ORGANIC ACIDS AND
ULTIMATELY TO CO2. BOTH PHOTOLYSIS AND
FENTON'S REAGENT WERE USED. DISCN.:
SOLVENT WAS WATER AND LIGHT SOURCE HG
VAPOR UV LAMP. WITHOUT H2O2, UV
DESTROYED LIGNIN AT LOW CONC.,
POLYMERIZED IT AT HIGHER CONCS. STUDY
WAS AT ACIDIC PH VALUES.

02427
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02427 0602
THOMPSON, N.S., AND CORBETT,
H.M.
THE REACTION OF PINE KRAFT
PULPS WITH POTASSIUM SUPEROXIDE
PROC. 1987 INT. OXYGEN DELIGN.
CONF., P. 105.
IN THE DEGRADATION OF KRAFT
PULP BY SUPEROXIDE IN DMSO, 2 TYPES OF
BEHAVIOR ARE SEEN. ONE IS SURFACE
EROSION AND THE OTHER INVOLVES
DEGRADATION OF THE AMORPHOUS REGIONS OF
CELLULOSE. YIELD LOSS WAS GREATEST AT
INTERMEDIATE LIGNIN CONTENTS.

02428
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02428 0603
SINGH, A.

PHENOXYL AND OXY-RADICALS AND
THEIR ROLE IN OXYGEN DELIGNIFICATION
PROC. 1987 INT. OXYGEN DELIGN.
CONF., P. 111.
OXYGEN REACTION MECHANISMS
INVOLVE THE FORMATION OF FREE RADICALS
SUCH AS SUPEROXIDE ANION AND PHENOXYL
RADICAL. THE PRODUCTION, DETECTION AND
REACTIONS OF THESE AND RELATED REACTIVE
SPECIES ARE DISCUSSED IN SOME DETAIL IN
THIS REVIEW. DISCN.:ORGANIC ADDITIVES
CAPABLE OF BEING OXIDIZED BY HYDROXYL
RADICAL TO A FORM THAT CAN REACT WITH
LIGNIN AND ACCELERATE OXYGEN BLEACHING
MAY BE WORTH LOOKING FOR. THE LIFETIME
OF SINGLET OXYGEN IS 3 MU-S IN H20, 60
MU-S IN D20.

02429
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02429 0604
HSU, C.L., AND HSIEH, J.S.

STUDY OF OXYGEN BLEACHING ++
KINETICS BY ULTRALOW CONSISTENCY EXPTS.
PROC. 1987 INT. OXYGEN DELIGN.
CONF., P. 119.
A 3-LEVEL FACTORIAL EXPERIMENT
WAS USED TO INVESTIGATE THE EFFECTS OF
OXYGEN PRESSURE, ALKALI CONCENTRATION
AND TEMPERATURE ON KAPPA NO. REDUCTION
IN OXYGEN BLEACHING. A RAPID INITIAL
STAGE WAS FOLLOWED BY A SLOWER STAGE.
SELECTIVITY WAS AFFECTED BY TEMP., BUT
NOT BY THE OTHER 2 VARS.

02430
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02430 0605
LJUNGGREN, S.C., AND
JOHANSSON, E.C.
REACTION KINETICS OF LIGNIN ++
OXYGEN ++ SOLVENTS, ++ PRESSURE AND PH
PROC. 1987 INT. OXYGEN DELIGN.
CONF., P. 125.
IN THIS MODEL STUDY, STILBENES
WERE SHOWN TO BE VERY REACTIVE, WITH A
RATE MAXIMUM AT PH 12. ADDITION OF
ORGANIC SOLVENTS AFFECTED THE RATES.
PHENOLIC COMPOUNDS WITH SATURATED
SIDECHAINS DIMERIZED TO RELATIVELY
STABLE BIPHENOLS. IT IS SUGGESTED THAT
THESE MAY BE RESPONSIBLE FOR THE SLOW
STAGE. DISCN.: PHENOXY RADICALS SHOULD
BE CAPABLE OF DIRECT COUPLING WITHOUT
INTERMEDIATE FORMATION OF
HYDROPEROXIDES.

02431
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02431 0701
VAN LIEROP, B., AND BROWN, G.

VARYING THE PURITY OF OXYGEN
GAS USED IN OXYGEN DELIGNIFICATION ++
PROC. 1987 INT. OXYGEN DELIGN.
CONF., P. 133.
THE EFFECT OF O2 PURITY IN THE
EO STAGE OF THE (CD)(EO)D SEQUENCE AND
IN THE O-STAGE OF THE O(CD)(EO)D WAS
STUDIED OVER THE RANGE FROM 21% TO 100%
O2 IN N2. THERE WAS LITTLE OR NO EFFECT

IN EO AND A MODERATE EFFECT IN O. DISCN: IN SOME CASES FINAL BRIGHTNESS DEPENDS ON O PURITY AT CONST. POSTEXTRACTION KAPPA NO. USE OF AIR IN EO WOULD BE COMPLICATED BY REQ. TO MIX LARGE VOL. OF GAS WITH PULP AND GAS ENTRAINMENT EFFECTS ON WASHING.

02432

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02432 0702

SAKUMA, S., SOTOBAYASHI, H., AND IWASE, H.

H.C. OXYGEN BLEACHING WITH P. S.A. (LOW PURITY) OXYGEN

PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 141.

A SAPOXAL HC OXYGEN STAGE AT THE JUJO PAPER CO.'S KUSHIRO MILL IS DESCRIBED, WITH EMPHASIS ON THE USE OF PRESSURE SWING ADSORPTION (P.S.A.) OXYGEN CONTAINING SOME N2. A NEW PIPELINE AND COMPRESSOR WERE NECESSARY. OPERATION IS SATISFACTORY AND SAVES $0.65 MM/Y. DISCN.: COULD NOT REACH BRTNS. TARGET OF 65 IN OH SEQ. WITH MC O-STAGE; HC IS NECESSARY. LIQUID O2 IS KEPT ON SITE AS BACKUP.

02433

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02433 0703

BANSAL, R.K.

ON-SITE PRESSURE SWING ADSORPTION OXYGEN SYSTEMS ++ PULP AND ++

PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 151.

VARIOUS TYPES OF PSA OXYGEN SYSTEMS SUITABLE FOR PULP AND PAPER MILLS ARE DESCRIBED, WITH REFERENCE TO THE CHARACTERISTICS AND ECONOMICS OF EACH. THEY CAN PRODUCE OXYGEN AT PURITY LEVELS OF 80-95% AND COSTS AS LOW AS $50/T.

02434

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02434 0801

LINDHOLM, C.A.

EFFECT OF PULP CONSISTENCY AND PH IN OZONE BLEACHING. PART 2 ++

PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 155.

THE RATE OF CARBOHYDRATE DEGRADATION IN OZONE BLEACHING IS AFFECTED BY CONSISTENCY BUT NOT BY PH. FOR KAPPA REDUCTIONS OF 50% OR LESS CONSISTENCY HAD NO EFFECT ON SELECTIVTY. OTHERWISE, LOW CONSISTENCY GAVE BETTER SELECTIVITY. DISCN.: FOR MC O3, WOULD NEED PSA SYSTEM.

02435

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02435 0802

MCDONOUGH, T.J., KIRK, R.C., BACKLUND, B., AND WINTER, L.

CATALYSIS IN PEROXIDE DELIGNIFICATION

PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 165.

THE BEHAVIOR OF KRAFT PULP IN ALKALINE H2O2 PARALLELS THAT OF MODEL COMPOUNDS, WHICH ARE DEGRADED AT A RATE THAT INCREASES AS THE RATE OF PEROXIDE DECOMPOSITION IS INCREASED. UNLIKE THE MODELS, HOWEVER, THE PULP REACTS SLOWLY WITH H2O2 THAT IS NOT DECOMPOSING. THE CARBOHYDRATE DEGRADATION IS VIRTUALLY ELIMINATED BY ADDING MANGANESE TO THE PULP.

02436

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02436 0803

ALTHOUSE, E.B., BOSTWICK, J.H. AND JAIN, D.K.

HYDROGEN PEROXIDE AND/OR OXYGEN TO ++ REPLACE ++ HYPOCHLORITE ++

PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 173.

MILL TRIAL, LAB AND LITERATURE DATA ARE USED TO EXAMINE THE FEASIBILITY OF USING H2O2 AND/OR O2 TO REPLACE HYPO IN CHEMICAL PULP SEQUENCES. HYPO CAN BE REPLACED OR REDUCED IN CEHED, CEHD, CEHH AND CEHDED SEQUENCES.

02437

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02437 0804

SUSS, H.U. AND HELMLING, O.

ACIDIC HYDROGEN PEROXIDE/ OXYGEN ++ PRIOR TO OXYGEN DELIGNIFIC ++

PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 179.

TREATMENT OF KRAFT PULP UNDER

ACIDIC CONDITIONS WITH H2O2 AND O2 IMPROVES DELIGNIFICATION IN A SUBSEQUENT OXYGEN STAGE. THE PRETREATMENT NEEDS NO SOPHISTICATED EQUIPMENT BUT IS LIMITED TO A 5 TO 10% INCREASE IN TOTAL DELIGNIFICATION.

02438

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02438 0805

FUHRMANN, F.E., AND PETER, W.

MC-OXYGEN PEROXIDE DELIGNIFICATION, AN ECONOMIC ALTERNA ++

PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 183.

THE (EP)HP SEQUENCE AT THE LENZING MILL WAS CONVERTED TO THE (EOP) HP SEQUENCE BY INSTALLING A MEDIUM CONSISTENCY OXYGEN STAGE. THE MILL IS AN *INTEGRATED PRODUCER OF DISSOLVING PULP* AND RAYON THAT USES THE ACID MG SULFITE PROCESS WITH BEECH AS RAW MATL. (EOP) WAS BETTER THAN O(EP). QUALITY WAS NOT CHANGED. DISCN.: OVERALL YIELD ABOUT 38% WITH SHRINKAGE 5-6%. ITS NOT EASY TO CONTROL ALPHA AND KAPPA SIMULTANEOUSLY. OXIDATION MAKES PITCH MORE OF A PROBLEM BUT DOESN'T CHANGE PITCH CONTENT.

02439

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02439 0901

JOEL, A.R.

SORBOZON(R) PROCESS, OZONE GENERATION WITH OXYGEN ++ RECYCLE

PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 191.

OZONE IS GENERATED FROM OXYGEN IN A SILENT ELECTRIC DISCHARGE AND THEN SEPARATED BY ADSORPTION ONTO AN INORGANIC ADSORBENT. THE OZONE IS SUBSEQUENTLY DESORBED WITHOUT THE USE OF A CARRIER GAS. THE OXYGEN WHICH IS NOT ADSORBED IS RECYCLED. DISCN.: UNIT IN OPERATION IN GERMANY; TARGETING MUNICIPAL WATER TRTMT MARKET; CAPABLE OF PRODUCING O3 AT 25% CONCENTRATION; BIG QUESTION FOR PULP BLEACHING APPLICATIONS REMAINS ATTACK ON CELLULOSE.

02440

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02440 0902

IDNER, K.

OXYGEN BLEACHING OF KRAFT PULP - HIGH CONSISTENCY VS. MEDIUM CONS ++

PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 195.

HC VS MC: CAPITAL HIGHER; OPERATING COSTS SAME (50-60 SEK/T LESS THAN CONVENTIONAL BLEACHING); VISCOSITY (SELECTIVITY) SLIGHTLY LOWER. TYPICAL MILL DATA FOR BOTH SYSTEMS, APPLIED TO BOTH PINE AND BIRCH, ARE GIVEN. ECONOMIC ANALYSES OF BOTH SYSTEMS ARE COMPARED. DISCN.: BETTER SELECTIVITY OF MC SYSTEMS ALLOWS LOWER KAPPAS TO BE REACHED.

02441

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02441 0903

BERGNOR, E., SANDSTROM, P., AND SJOBLOM, K.

MODIFIED COOKING AND OXYGEN BLEACHING FOR ++ ECONOMY ++ EFFLUENT ++

PROC. 1987 INT. OXYGEN DELIGN. CONF., P. 201.

THE SEQUENCE MODIFIED COOKING-O(CD)(EO)D WAS COMPARED IN THE LAB WITH CONVENTIONAL COOKING-O(CD)(EO)DED. MOD COOK TO KAPPA 28 WITH O TO KAPPA 12 GIVES THE LOWEST COST AT CONSTANT QUALITY ($9/T LOWER THAN CONV). THE MOD COOK SHORT SEQUENCE GIVES REDUCTIONS IN TOCL OF 25% AND COD OF 20%. DISCN.: PULPS PERFECTLY WASHED; AUTHORITIES IN SWEDEN MAY SANCTION FOR TOCL CONTROL; MODO PREFERS 5 STAGES AFTER OXYGEN - 3 TOO DIFFICULT TO CONTROL FOR CONSTANT PRODUCT QUALITY.

02442

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02442 1301

PANELISTS FROM EARLIER PANELS AND GENERAL AUDIENCE

GENERAL PANEL DISCUSSION AT 1987 INT OXYGEN DELIGN. CONF.

E. MALCOLM - PERSONAL COMMUN.

RE 1987 INT. OXYGEN DELIGN. CONF.

USE OF PRESSURE SWING OXYGEN IN BLEACHING SYSTEMS IS NOT WIDESPREAD BECAUSE IT HAS NOT BEEN PROMOTED. TOCL MAY NOT BE GOOD CONTROL PARAMETER. SHORT SEQUENCE PROBLEMS INCLUDE REVERSION, CONTROL. TRAPPING AND PRECIPITATION OF CALCIUM ON WASHERS IS A PROBLEM WITH ACIDIC RECYCLE STREAMS. LIMITING THE